

DTIC FILE COPY

1

REPORT 89-11-05

AD-A215 552

DTIC
ELECTE
DEC 0 4 1989
S D GS D

ESTIMATING MULTIYEAR PROCUREMENT
COST SAVINGS FOR NDI
TACTICAL WHEELED VEHICLES



COST ANALYSIS DIVISION
(AMSTA-VC)

WHEELED VEHICLE BRANCH
(AMSTA-VCW)

AUGUST 1989

PATRICK G. NUNEZ (GS-07)

DISTRIBUTION STATEMENT A

Approved for public release
Distribution Unlimited

TACOM

COMMERCIAL (313) 574-8695

AUTOVON (8) 786-8695

Systems and Cost Analysis Directorate

89 11 30 092

(A)

TABLE OF CONTENTS

1. INTRODUCTION	1
A. Annual Contracting	1
B. Multiyear Contracting	1
C. Candidate Selection Criteria	2
D. Cost Estimating Problems	3
2. ADVANTAGES AND DISADVANTAGES OF MULTIYEAR PROCUREMENT	4
A. Advantages	
1. Modernization of Production Facilities	5
2. Reduced Unit Cost	6
a. labor costs	6
b. material cost	7
c. overhead cost	8
d. nonrecurring costs	8
B. Disadvantages	9
3. COST ESTIMATING	
A. Contractor Survey	10
B. Survey Results	10

Accession For	
NTIS CRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution /	
Availability Codes	
Dist	Avail and/or Special
A-1	

APPENDIX - SURVEY QUESTIONS

1. INTRODUCTION

A. Annual Contracting

Typically, Department of Defense contracts have been annually negotiated. If the procured items are required in quantities that span several years, then successive annual contracts are awarded competitively each year. The contractor must set up his assembly line, hire employees, and negotiate contracts with vendors and suppliers for the one year quantity. The next year, since the contract is awarded in a competitive environment, a different contractor may win the award. The entire process must then be repeated.

If the second contract is awarded to the same contractor that received the first, then most of the tooling, hiring and subcontracting actions will be avoided. This will decrease the cost the contractor incurs and the price that the government will pay.

B. Multiyear Contracting

Multiyear procurement is a method of procuring items over several years under one contract. A multiyear contract may hold several economic advantages over annual contracts. Since a multiyear contract involves a large number of units from a single contractor, fixed costs are amortized over the larger quantity. This will reduce the unit cost of the item or encourage a contractor to modernize production facilities, or both.

Several other factors that will be discussed later lower the unit cost of the item. Also, the contractor work force will be stabilized because of the longevity of the contract.

Congress, however, has had reservations about approving multiyear contracts. Budgeting flexibility is hampered because money must be approved for the program each year or a large cancellation fee will be paid. Problems with front loaded costs also discourage the use of multiyear procurement.

The effect of multiyear procurement on competition in the defense industry is debatable. The large dollar amounts and the promise of stability may encourage competition, but the relative infrequency of contracts may weaken competition.

In the National Defense Authorization Act of 1988 and 1989, only those multiyear candidates that showed estimated savings of twelve percent or greater were approved. A difficulty exists in determining with confidence what percent savings will actually be realized. This paper will discuss the above ideas and attempt to quantify the advantages and disadvantages. The results will be used in forecasting costs for items purchased using multiyear procurement in the Tank-Automotive Command (TACOM) Wheeled Vehicle Cost Analysis Branch.

C. Candidate Selection Criteria

The criteria used in the selection of multiyear procurement candidates for

congressional approval are rigorous and are created to avoid situations in which the government will be liable for large cancellation costs. A candidate program must be a stable program in terms of the quantity, design and funding. A large degree of confidence must exist in the candidate's management skills and production capabilities. The last criterion, which this paper addresses, is that the costs of both the multiyear contract and the separate annual contracts must be known with a reasonable amount of confidence and the government must realize some savings by opting for the multiyear contract.

D. Cost Estimating Problems

Although multiyear procurement is not a new idea, relatively little data is available to develop estimates of the savings associated with this contracting method. Ideally, from a cost analyst's viewpoint, a request for proposal will call for both an annual contract proposal and a multiyear proposal. The estimate can then be assembled based upon the data in the proposals. The TACOM procurement office does not feel comfortable with this idea because of the possibility of a buy-in on the annual contract. A buy-in is when the contractor presents a low initial estimate in order to win the contract, while planning to increase the cost in the follow-on contracts when it has an advantage over the competition. One solution would be to request a proposal on the annual contract with several option years also costed separately. This would allow the government to detect any buy-in situations and also provide reliable data for the cost estimating purposes.

Until reliable historical data is obtained (or the contractors submit trustworthy annual and multiyear contract proposals), the cost estimator will have a difficult time developing reliable cost estimates for the savings. The increased attention to multiyear procurement recently has increased the visibility of these estimates. In an attempt to develop a useful method of estimating the savings, a survey of some of the major contractors for Army wheeled vehicles is used. The survey yields percent savings associated with different cost categories based upon the opinions of the major producers.

Caution should be used in applying the figures found in this report. It must be remembered that the survey participants produce wheeled vehicles for the Army. Most of these vehicles are largely nondevelopmental items (NDI). As such, the results are probably different than those that would occur in a survey of contractors involved with developmental items. The distinction here is not in terms of the cost of the developmental work - this paper addresses only procurement contracts - but in the fact that a NDI producer uses equipment and technology that also has a commercial market. A defense specific developmental item which has no commercial market will probably realize benefits to a greater degree under a multiyear procurement than NDI items.

2. ADVANTAGES AND DISADVANTAGES OF MYP

A. Advantages

There are several areas that MYP proponents believe will result in

advantages to the government and the country as a whole when compared with annual contracts. The unit cost of the end item will decrease. The labor pool will be stabilized and the worker's morale (and presumably productivity) will increase for the MYF contractor as it is virtually assured of several years with no break in production. Plant modernization will appear more attractive to the contractor, and the contractor's surge capability may increase allowing for a much quicker conversion from peacetime to wartime conditions. Also, competition for government contracts may increase because of the large dollar amounts involved and the stability that the long contracts promise.

1. Modernization of Facilities

Since a multiyear contract contains larger quantities than an annual contract, the opportunity for initial investments into production facilities is much greater than under a single annual contract. With no guarantee that it will receive the follow-on contracts, the producer must recuperate all the initial nonrecurring costs in the one year. This drives the price of each unit up and could cause the contractor to lose the bid. With this constraint, a contractor is less willing to update assembly line processes. However, when nondevelopmental items (NDI) are the procured system, many of the contractors also have large commercial markets. These contractors are motivated to continuously improve their processes by market pressures outside the department of defense, so the effect of multiyear procurement on the contractor's willingness to modernize its facilities is not as significant as it would be for developmental systems where the commercial market does not

exist. Nevertheless, an NDI producer will be encouraged to take advantage of the investment opportunities available under multiyear procurement contracts.

2. Reduced Unit Costs

The unit cost of a weapon system may be lower under a multiyear contract because of several factors. Labor, raw materials, overhead, capital investment, tooling and subcontractor/supplier costs all affect the unit cost of the system.

a. Labor Cost

Labor costs may be reduced for two reasons. The first is the longer duration of the contract, which allows more efficient labor force planning. When a contractor is awarded an annual contract, the labor force is planned for the one year only. This may require hiring and training new employees. If a different contractor was to be awarded the second contract then people would have to be hired and trained again for the new company. Each time that a contract is awarded to a new contractor, the government winds up paying extra for the training and hiring costs that the contractors incur. It is possible that successive annual contracts could be awarded to the same contractor and these costs would not reoccur.

There is still another advantage in the labor pool category that multiyear contracts hold over annual contracts. The stability and duration of the multiyear contracts allow for longer range planning and more flexibility to the contractor. If the quantity initially expected was to change, then the

contractor under a multiyear would be able to adjust to the change in a more efficient way than the contractor under an annual contract. While one of the criterion for multiyear procurement approval is that the quantity of vehicles to be procured is stable, the possibility of changes still exists.

The second reason for reduced labor costs is due to the effects of learning. If a multiyear contract is awarded, then the effects of learning accumulate over the life of the contract. If annual contracts are awarded, then the effects of learning only accumulate over the one year of the contract. Each new contract awarded takes us back to the beginning of the learning curve.

b. Material Cost

Raw material costs also contribute to the decrease in unit cost for multiyear contracts. The large quantities and the extended duration of the multiyear contract allow the contractor to purchase in economic lot quantities more frequently than an annual contract would allow.

Economic lot quantities are defined as the optimal quantity to be purchased periodically in terms of demand, cost of maintaining inventory and the cost of reordering. The contractor under a multiyear procurement will be allowed more freedom over the quantity of supplies/components that are purchased. In annual contracting, quantities purchased are much more restrictive. The fact that fewer units are to be purchased under each contract confines the producer from arranging the ordering and delivery of supplies and components in time frames that would reduce the cost. For short lead time items, this

may be a small restriction; but for longer lead time items, the effect on the cost can be significant.

c. Overhead Costs

A contractor's overhead cost may be reduced because of the duration of a multiyear contract. Similar to the reasons behind the labor savings, the production process may be planned more efficiently. The stability of a multiyear contract allows the contractor to use production methods that will decrease overhead, such as a "just in time" production/assembly processes.

d. Nonrecurring Costs

Nonrecurring costs are amortized over the quantity of the vehicles purchased in determining the unit price that appears in a contract. For a given dollar amount of nonrecurring initial investments, the larger quantity of vehicles in a multiyear contract results in a lower per unit nonrecurring cost than for an annual contract.

This nonrecurring cost idea could be looked at in another way to show another advantage that multiyear procurement may have over annual procurements. The contractor may be able to invest a greater amount of money into productivity-improving equipment or technology while still keeping the

amortized nonrecurring costs at the same level or lower than that of the annual procurement. These productivity improvements will further decrease the labor costs that have already been discussed. In either case the government will benefit. Either lower costs will appear in the contract or the technological and manufacturing base of the defense industry will be improved. This improvement in the defense industry will filter into systems that are not procured through multiyear contracts.

8. Disadvantages

While the above mentioned benefits may seem enticing to a government attempting to allocate its limited resources in the most efficient way, there are some drawbacks to multiyear contracts that should also be considered. In order to encourage initial investment to improve a contractor's production facilities, the government should be willing to guarantee reimbursement for a large portion if not all the contractor's nonrecurring investment costs. This may result in a large sum of money that the government will be liable for if the contract is cancelled. Also, in approving the multiyear contract, future congresses will be saddled with the responsibility to fund programs that they had no control over, or risk large losses due to cancellation charges. The multiyear contract may contain front loaded costs in order to recuperate the contractors initial investment quicker and lessen whatever losses the contractor would incur in a cancelled multiyear contract. Also, opponents of MYF claim that competition in the defense industry will decrease because of the infrequent contract awards.

3. COST ESTIMATING

A. Contractor Survey

A survey of six of the more prominent tactical wheeled vehicle manufacturers was conducted by TACOM's Cost Analysis Wheeled Vehicle Branch. This survey included questions that would give some indication of how much cost savings would be realized for multiyear procurement acquisitions over annual acquisitions. The question portion of the survey is appended to this report. The companies surveyed were Navistar International Transportation Corporation, General Motors Military Vehicle Operations, Oshkosh Truck Company, Teledyne Continental Motors, AM General Division of LTV Missile and Electronics Group, and BMY. Personnel from various levels of management and different levels of experience with government contracts were asked to respond to fourteen questions touching on different areas of potential savings to the government due to multiyear contracting.

The first section of the survey contains six questions addressing perceived benefits. The surveyed individuals were asked to respond on a scale of one to seven with one being strong disagreement, four being neutral, and seven being strongly agree. These questions were meant to qualitatively determine whether potential advantages exist in the areas of average unit costs, contract administrative costs, labor costs, stabilized manpower loading, plant modernization and vendor competition.

The second and third sections of the survey attempt to quantitatively estimate the savings that the government would realize during multiyear procurement acquisitions. Both sections are based on a scenario that involves the procurement of 4000 ten ton trucks over a five year period with quantities divided equally over each year. Two methods of procurement are involved. A five year multiyear procurement is to be compared to five annual competitive contracts.

Section two of the survey places the estimates in the time frame before any contract awards. Therefore, the second section of the survey would give a measure of the estimated savings that the government would realize if it is assumed that the same contractor does not receive all five contracts. The topics addressed in this section are labor savings, labor overhead, material and subassembly cost, material overhead, tooling, other nonrecurring costs, proposal preparation and G&A rate.

The third section is intended to determine the effect of having the same contractor receive all five annual contracts. The cost savings in the third section are expected to be lower than those in the second since the third section is closer to the situation of a multiyear contract.

B. Survey Results

The survey responses for section one were analyzed to determine how strongly the contractors felt savings would be realized in different areas. The responses were averaged and tested for statistical significance. All the responses proved significant and the resulting ratings are listed below;

<u>COST CATEGORY</u>	<u>AVERAGE RESPONSE</u>
Reduced average cost	Agree/Strongly agree
Increased contract admin costs	Disagree/Slightly disagree
Reduced labor costs	Agree/Slightly agree
Stabilized prod manpower	Strongly agree
Decreased plant modernization	Disagree
More vendor competition	Agree

From the above results, cost savings to the government will occur in several areas. Administrative costs will decrease due to the lower number of proposals prepared, less production planning time, and fewer ordering actions between the contractor and the government and the contractor and its subcontractors. Labor cost will decrease because of efficient staffing and increased learning. The increased competition at the vendor level will lower the cost the contractor pays. These factors together will decrease the unit cost of each item purchased.

The country's defense industry will be strengthened because of the stabilized production manpower and plant modernization. These factors may not result in monetary savings to the government apparent in the multiyear contract, but overall, result in a better economy.

The survey responses in sections two and three were analyzed to develop a cost savings factor for multiyear procurement over annual procurement. Since the advantages of multiyear procurement are being investigated, a one sided hypothesis test is used with the null hypothesis being that no advantage exists for multiyear procurement. If the test proves statistically significant, then the average of the responses is the cost savings factor. Also, for use in sensitivity analyses, the standard deviation is provided. The statistics are based upon 14 data points for each question. All the results were found to be statistically significant.

Section Two Survey Results

	PERCENT SAVINGS	
	AVERAGE	STANDARD DEVIATION
Labor Unit Cost	7.27	3.8581
Direct labor overhead	6.52	4.0751
Material/subassembly cost	8.61	2.8835
Material overhead	6.89	4.1803
Tooling	13.12	11.1558
Other nonrecurring	9.42	8.2431
Proposal preparation	10.33	7.7144
G&A rate	5.55	4.8203

Section Three Survey Results

	PERCENT SAVINGS	
	AVERAGE	STANDARD DEVIATION
Tooling	4.40	8.1676
Other nonrecurring	3.64	6.2496
Proposal preparation	8.29	14.5219
G&A rate	5.93	5.1473

Those factors in section two are those that will be used at TACOM. The assumption inherent in the factors is that different contractors will receive the contract award in each year. This is a worst case scenario in terms of cost and will result in a high estimate for the cost savings. Those rates in section three are applicable when the assumption that the same contractor will receive all of the successive contracts. This will give a low estimate of the savings.

A proposal or a source that is developed from an industrial engineering approach would be the ideal source for applying these factors. These types of estimates identify the costs at the lowest level; thus, the amount of material purchased, labor hours, tooling costs, administrative costs, etc. may be easily identified and the appropriate factors applied to each category. When the data is not available in this form (for example, a unit cost of an item is the only value known), then the analyst needs to develop a methodology to estimate what portions of the cost may be attributed to each category, be it by assuming certain percentages or

by analogy with similar systems for which an industrial engineering estimate is available, or another method. Confidence in the estimate will be greatly reduced under these circumstances.

The author hopes that the above values will be used with discretion. Each weapon system purchased by the defense Department has its own peculiarities. The above values are for situations that involve nondevelopmental tactical wheeled vehicles. Weapon systems that require a large amount of initial tooling and developmental work will probably show larger savings. A similar survey could be used to develop similar figures for developmental items. It should be realized, however, that in order to ensure confidence in estimates of this sort and to develop a reliable cost database, requests for proposals should require the contractors to return bids for both multiyear contracts and a single annual contract.

The following questions relate to multiyear procurement issues. Please answer each of the six statements below by circling one of seven responses. These seven responses are displayed on the answer scale that follows each statement.

1 2 3 4 5 6 7
strongly neutral strongly
disagree agree

1 2 3 4 5 6 7
strongly neutral strongly
disagree agree

1 2 3 4 5 6 7
strongly neutral strongly
disagree agree

1 2 3 4 5 6 7
strongly neutral strongly
disagree agree

1 2 3 4 5 6 7
strongly neutral strongly
disagree agree

1 2 3 4 5 6 7
strongly neutral strongly
disagree agree

SECTION II

In this section, you are asked to compare multiyear procurement and annual contracting. All questions will be asked in the context of the following situations.

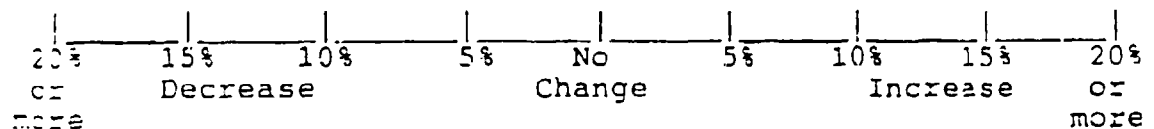
Situation 1. The Army is planning to replace a 10 Ton truck. Budget requirements specify that these vehicles will be purchased over the next five years. The total planned procurement quantity is 4000 vehicles, spread evenly over the five years. The acquisition strategy in this scenario calls for five competitive annual contracts to procure the trucks.

Situation 2. Assume the same situation as above except that the acquisition strategy calls for the use of a single five-year multiyear contract with contract cancellation clauses for non-recurring costs. Quantities will again be evenly spaced over five years.

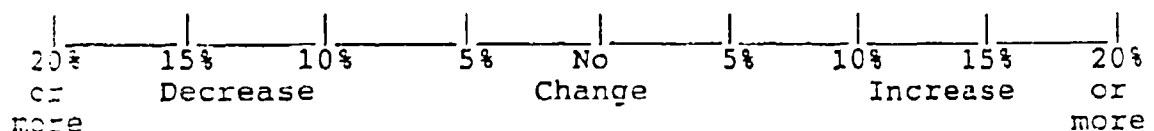
Assume that your firm is bidding under both situations at the first year of the program. Quantity in the first year is one-fifth of the total five-year program quantity. Under Situation 1, a successful bid in year one does not guarantee success in follow-on contracts.

The scales below represent a percentage change for different types of cost. Based on the experience of your production contracts for the last five years, please estimate the cost impact that would be the result of Situation II (MYP) compared to Situation I (annual contracting).

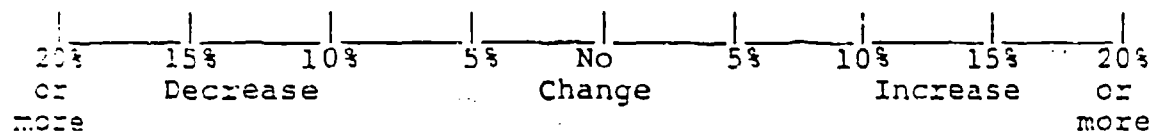
15. What would be the impact on direct labor cost per unit produced for a five-year multiyear contract compared to one annual contract?



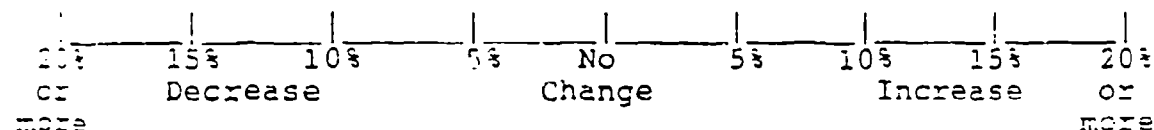
16. What would be the impact on direct labor overhead cost per unit produced for a five-year multiyear contract compared to one annual contract?



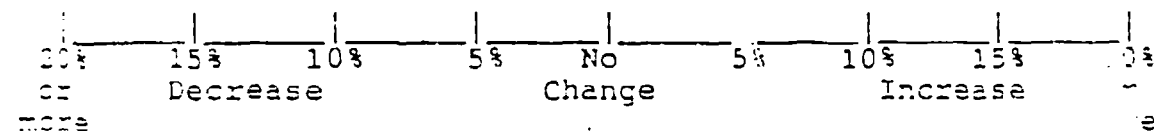
17. What would be the impact on materiel and subassembly cost per unit produced for a five-year multiyear contract compared to one annual contract?



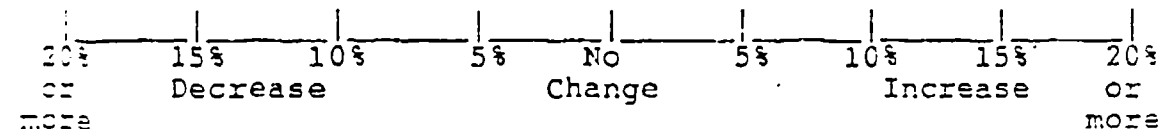
18. What would be the impact on materiel overhead cost per unit produced for a five-year multiyear contract compared to one annual contract?



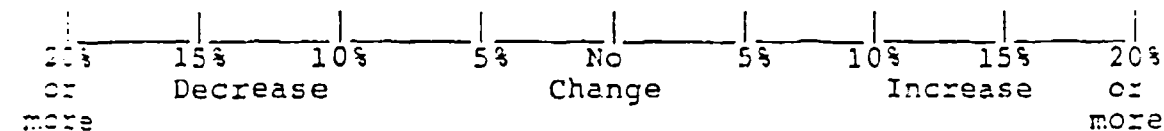
19. What would be the impact on tooling costs for a five-year multiyear contract compared to one annual contract?



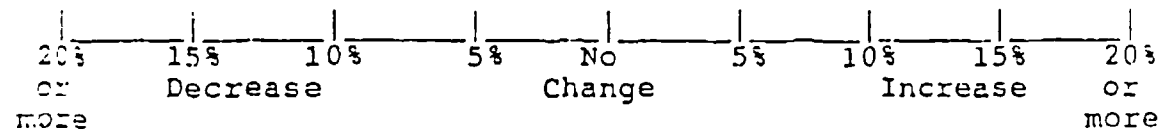
20. What would be the impact on other nonrecurring costs for a five-year multiyear contract compared to one annual contract?



21. What would be the impact on cost of preparing proposals for a five-year multiyear contract compared to one annual contract?



22. What would be the impact on the General and Administrative (G&A) rate for a five year multiyear contract compared to a single annual contract?



SECTION III

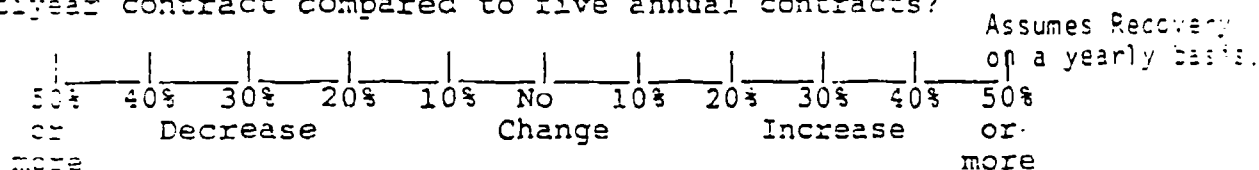
In this section, you are asked to compare multiyear procurement and annual contracting. All questions will again be asked in the context of the following situations.

Situation 1. The Army is planning to replace a 10 Ton truck. Budget requirements specify that these vehicles will be purchased over the next five years. The total planned procurement quantity is 4000 vehicles, spread evenly over the five years. The acquisition strategy in this scenario calls for five competitive annual contracts to procure the trucks.

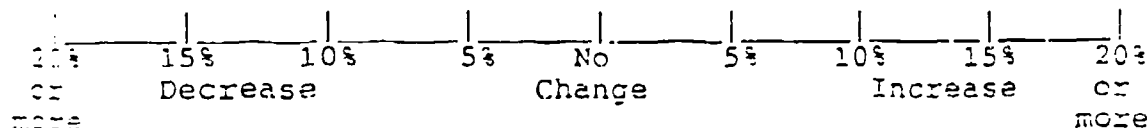
Situation 2. Assume the same situation as above except that the acquisition strategy calls for the use of a single five-year multiyear contract with contract cancellation clauses for non-recurring costs. Quantities will again be evenly spaced over five years.

Assume that we are now at the end of the five year procurement program. Under situation one, your firm has been successful in winning all five annual contracts. Compare estimated total costs for the five year multiyear contract against five annual contracts.

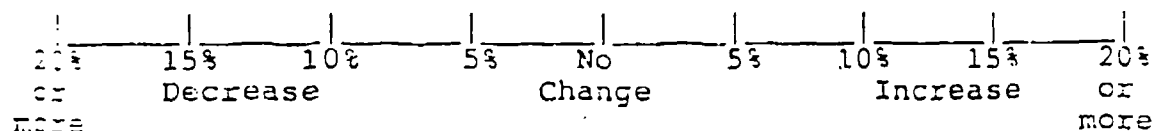
23. What would be the impact on tooling costs for a five-year multiyear contract compared to five annual contracts?



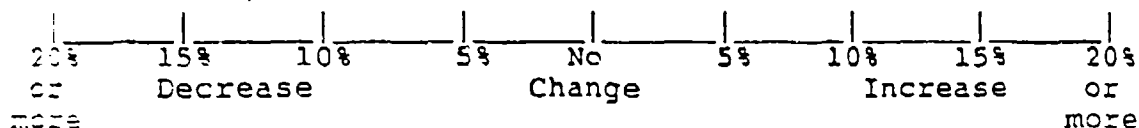
24. What would be the impact on other nonrecurring costs for a five-year multiyear contract compared to five annual contracts?



25. What would be the impact on cost of preparing proposals for a five-year multiyear contract compared to five annual contracts?



26. What would be the impact on G&A rate of a five-year multiyear contract compared to five annual contracts?



SECTION II

In this section, we are soliciting any comments you may have on the pro's and con's of both of the acquisition strategies addressed above. Feel free to make comments concerning any aspect of multiyear vs. annual contracting. In particular, please provide comments which may help to clarify responses to individual survey questions.

1. Lower cost labor and training requirements.
2. Costs spread over five years versus one year.
3. More competition and stability, long-term relationships.

2-Way Memo

Subject: Technical Paper For Presentation at the
23rd Annual DoD Cost Analysis Symposium
on "Learning and Using Learning Curves"

From : PAM
ATTN: Ron Fry

INSTRUCTIONS

Use routing symbols whenever possible.

SENDER (Originator of message):
Use brief, informal language.
Conserve space.
Forward original and one copy.

RECEIVER (Replier to message):
Reply below the message, keep one
copy, return one copy.

DATE OF MESSAGE

1 Sep 89

ROUTING SYMBOL

ACCCF

SIGNATURE OF ORIGINATOR

Pam Upton 7-3927

TITLE OF ORIGINATOR

Cost Analyst

FOUO

MESSAGE

FOUO

Attached is a paper to be presented to above next week for your review. Just finished this morning & will go TDY next week, so need review today.

This article contains no classified information and is as technically correct as the author can make it.

REPLY

The attached paper has been reviewed and is cleared for public release.

To :

DATE OF REPLY

1 Sep 89

ROUTING SYMBOL

PAM

SIGNATURE OF REPLIER

Ron Fry

TITLE OF REPLIER

Public affairs specialist

2. RETURNED TO ORIGINATOR

5027-107

OPTIONAL FORM 27 (Rev. 7-81)
GSA FPMR (41 CFR) 101-11.6
NSN 7540-00-002-2447

OPSEC REVIEW
(AR 530-1, Operations Security)

The purpose of the OPSEC Review is to preclude the inadvertent release of EEFI (Essential Elements of Friendly Information) and unclassified/sensitive information regarding TACOM programs, projects and operations. EEFI is defined as any information which if exposed to foreign intelligence agencies, would serve as intelligence indicators and thus tend to compromise U.S. intentions, operations, research, development and technology.

The OPSEC Review of information proposed for public release is conducted by the Security Office and technically qualified individual(s), other than the author. This includes speeches, papers, manuscripts, reports, technical manuals, etc., prepared by TACOM personnel and contractors. The reviewer(s) determines whether the benefit of release outweigh the potential damage to national security.

The OPSEC reviewer(s) will indicate their concurrence with the release of the information by signing the statement below:

I understand the hostile intelligence interest in TACOM programs, projects and operations.

I am technically qualified to conduct an OPSEC Review of the proposed for release entitled: ESTIMATING MULTIVEAR
PROCUREMENT COST SAVINGS FOR NDT
TACTICAL WHEELED VEHICLES
and have determined that its release is clearly consistent with the objectives of the TACOM OPSEC Program.

Technical Review

15 SEP 59

Edward S. Bragg C, World Veh Br
Signature/Title/Date (AMSTA-VCW)

Security Office - Concur/Nonconcur P. J. [Signature] DATE 11 Nov 59

Over: Art E. [Signature]
C, PAC, TACOM